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PALEOLYMNOLOGICAL CHANGES IN THE LAKE-LEVELS ON THE TERRITORY OF BELARUS, LATVIA AND ESTONIA IN THE LATE GLACIAL AND THE HOLOCENE

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Analysis of the sedimentary cores of Belarus, Latvia and Estonia located within the meridional transect with a pronounced gradient of the natural conditions of the Late Glacial and Holocene allows us to trace and explain the synchronism/asynchrony of the changes in lake levels as an indicator of the transformation of climate, vegetation, landscapes, in a fairly large region of Europe – The Baltic Lakes District. As the reference objects of the study, Juusa in Estonia, the lake. Kuji in Latvia and the lake. Dolgoe in Belarus. The choice of these objects is due to a single glacial genesis and similar features of the lagging of lakes within various marginal stages of the Wurm ice retreat, as well as to a complex of paleogeographical studies of the history of the development of the water bodies themselves and the adjacent watersheds on the basis of lithologic-stratigraphic, paleofloristic, radiocarbon and isotope-geochemical diagnostic methods.

Based on the analysis of the conducted paleogeographical studies, the reconstruction of the level changes in the lakes of Estonia in Latvia and Belarus in the postglacial period was carried out, during which a number of general patterns (Fig. 1).

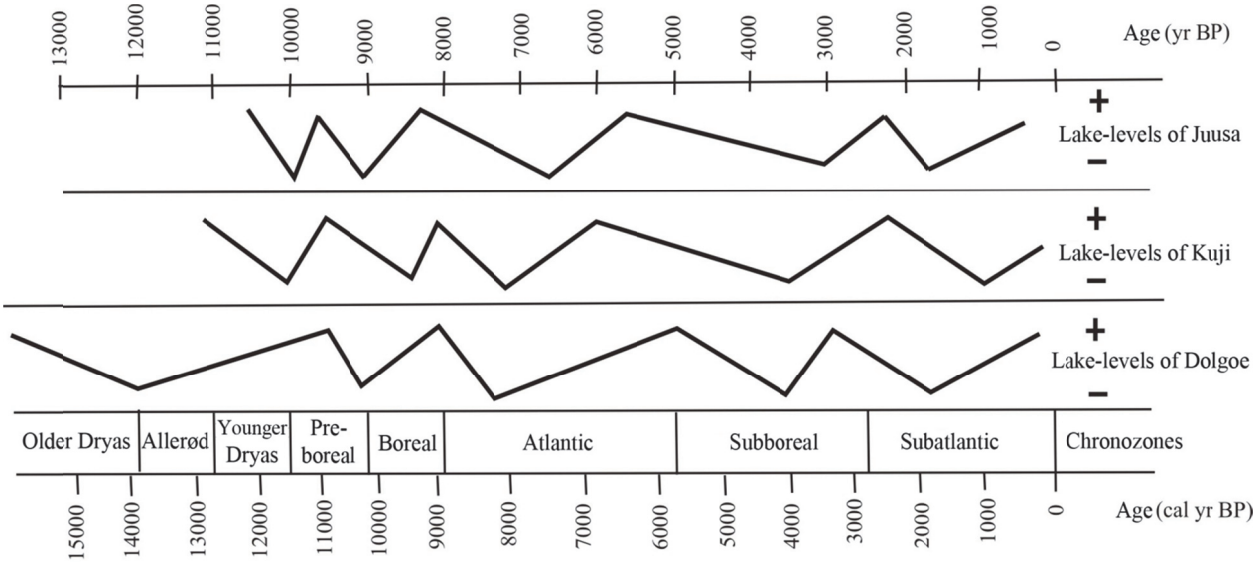

Fig. 1. The dynamics of changes in lake levels in the Baltic Lakes District in the postglacial period

First of all, a clearly expressed minimum of levels, characteristic of the early stages of the late glacial period, is recorded in the lake Dolgoe. Low level marks, were due to a sharp cooling and the incompleteness of the process of the conservation of glaciocarst. A slight increase in watercut in the territory, which occurred in the Allerød - the beginning of the Younger Dryas, is observed in the lakes of Kuji and Dolgoe, which is associated with the warming of the climate of that time and the activation of glaciokarst processes. The deepest depressions of the lake basins of southern Estonia at that time remained canned ice. The increased cooling in the Younger Dryas was probably accompanied by an increase in the humidity of the climate and the rise in lake levels. Intensive soil nutrition in the waters of the Juusa and Kuji caused the flow of carbonate and terrigenous material and the beginning of the formation of lake sediments. However, already in the first half of the Preboreal, there was a tendency to lower levels for all three lakes, which was due to a decrease in the humidity of the climate and a decline in fluvial activity. This period includes finds of low-power layers of ancient peat in all the studied lakes.

The formation of peat was facilitated by the onset of warming of the climate and activation of the processes of unloading thawed waters of permafrost due to the intensification of infiltration processes. From the second half of the Preboreal, the region-wide dynamics of lake level rise is observed in the investigated lake sections, due to the global trend of warming and humid climate in the northeast of the Holocene. The mineral and organomineral deposits of late glaciation prevailing before that date start to overlap with rocks of the carbonate composition due to the leaching of carbonate moraine as a result of increased fluvial activity. In the epoch of sedimentation of carbonate sediments, the lakes possessed the character of oligo-mezotrophic water bodies with a low organic content in the bottom sediments. Important in this case were the morphological features of the lake basins and the lithology of the water reservoir rocks. The process of raising the levels continued until the beginning - the middle of the Boreal. The next fall in temperature, which occurred at that time, led to a decrease in hydration and lowering of levels.

At the end of the Boreal - the beginning of the Atlantic, the process of stabilizing levels with a general tendency to overflow is traced, but already about seven thousand years ago the stage of the next decline of levels has come, which reflects the interruption of the lake sedimentation in the section on the littoral zone of the lake Dolgoe. This period corresponds to a change in the nature of sedimentation in all the lakes studied. The predominant carbonate component of lake sediments towards the middle of the Atlantic is either reduced by a fraction of the $CaCO_3$ content, or completely smoothed by an organomineral one. The reasons for the replacement of carbonate deposits by organic ones were complex: leaching of catchment areas, which resulted in a reduction in the inflow of hard waters; cooling in the beginning of Subboreal, determining the termination or slowing down of the formation of lake carbonates; increase of trophic status due to the development of plant and animal life in them. The cold and humid conditions of the Subboreal contributed to the onset of another trend towards higher levels, which was accompanied by an increase in mineral components in the sediments of all lakes. In addition, in the former littoral parts of lake Dolgoe, the process of lake sedimentation resumed. In the second half of Subboreal, the fluctuations differed in their diverse nature, which was due to local factors, but by the beginning of the Subatlantic, the process of warming and humidifying the climate caused another common phase of recovery in all the lakes in the region studied. At present, the analysis of lake sedimentation confirms the regression stages in the dynamics of changes in the levels of the studied lakes, which began about a thousand years ago.

Most of the revealed regularities in lake sedimentation have general tendencies for the Baltic Lakes District, which is associated with global paleoclimatic transformations in the Late Glacial and Holocene. However, in climatic cycles associated with periods of cooling and increase in moisture content from northwest to southeast, some delay in the stages of changes in the nature of sedimentation and, as a consequence, fluctuations in lake levels, are found. Conversely, for paleocycles with a warming and a decrease in moisture content, a reverse scenario is observed that, in addition to the influence of local factors in the catchment areas, can be explained by an increase in the gradient of the continentality of the climate along the meridional transect: the lakes Juusa - Kuji - Dolgoe. This

is confirmed by palynological data, according to which it was established that the most significant climatic events of the Holocene (late Boreal, middle Atlantic and early Subboreal cooling) in Belarus looked brighter than in the territory of the Baltic States.

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THE FEATURES OF MINERAL FORMATION PROCESSES IN LAKE PETUKHOVO (KULUNDA PLAIN)

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Lake Petukhovo (Altai Krai) is located in the ribbon-like (relict) pine forest of the Kulunda plain steppe zone. Lake Petukhovo is a small drainless lake with sapropel deposits (the lake mirror area is 4.7 sq. km). Large stromatolite formations were found in the coastal zone of the southeastern shore of the lake.

The aim of the work is to establish the features of modern mineral formation in the Lake Petukhovo and compare the mineralogical and geochemical characteristics of the lake ecosystem components. The objects of study – the Lake Petukhovo ecosystem components.

The fieldwork was carried out as part of a complex expedition in 2015 and 2017. Bottom sediments were collected from the catamaran by a cylindrical sampler with a vacuum shutter (diameter 82 mm, length 50 cm). The core samples of bottom sediments were sampled with an interval of 3-5cm. Coastal area sediments were sampled in layers. Physical and chemical variables were recorded in situ (pH, Eh, TDS).

Further studies of the samples chemical composition were held at the Center for collective usage of scientific equipment for multi-element and isotopic studies of SB RAS, Laboratory of Geochemistry of noble and rare elements and ecogeochemistry of IGM SB RAS. The bottom sediments macro- and microelement composition was determined by atomic absorption method. The macroelement composition was determined by X–ray fluorescence analysis. X-ray diffractometry (XRD) was used